

Reservoir Ranching of Paddlefish, *Polyodon spathula*: Results of a Public Opinion Survey in Kentucky

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ABSTRACT. Reservoir ranching is an extensive aquaculture practice which stocks young fish that feed on naturally available foods, and are harvested after a period of time. Paddlefish, *Polyodon spathula*, are filter feeders on zooplankton and are valued for their boneless meat and roe that can be processed into caviar. The goal of this study was to report the perceptions that Kentuckians have of paddlefish reservoir ranching in public waters. Our results show that over 80% of surveyed respondents (N = 478) were in favor of this practice. However, almost 20% of respondents indicated that reservoir ranching of paddlefish might be deleterious for sport fishing in the reservoirs selected for this aquaculture method. A similar proportion of the surveyed sample was against instituting reservoir ranching of paddlefish in public waters. Other results showed that respondent characteristics, such as fishing license ownership and education level, systematically affected their opinion of reservoir ranching. Individuals without fishing licenses and without 4-year college degrees (or higher education), were significantly ($P < 10\%$) more willing to institute reservoir ranching and less inclined to feel that reservoir ranching will harm sport fishing in public bodies of water.

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Conclusions of this study were that while the majority of respondents were in favor of reservoir ranching of paddlefish in public waters, some were concerned with potential effects of this enterprise on sport fishing. Since scientific studies in this area had been sparse, this paper suggests that research on the possible impacts of paddlefish ranching on sport fishing in public waters should be imperative prior to instituting this new aquaculture industry. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <<http://www.HaworthPress.com>> © 2006 by The Haworth Press, Inc. All rights reserved.]

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INTRODUCTION

Paddlefish, *Polyodon spathula*, are zooplanktivores that constantly swim and filter the water for food. As such paddlefish aquaculture typically calls for large bodies of water, particularly if the fish are to be harvested at maturity. Reservoir ranching of paddlefish involves stocking young female fish in reservoirs at a density of 12.5/ha, in which they can grow without any added feed, supplemental aeration, or chemicals (Semmens and Shelton 1986; Onders et al. 2001). Female paddlefish will be gravid at 8-10 years of age, at which time they can be harvested for meat and roe (Mims et al. 1999).

While paddlefish meat is a high-quality product, the roe, processed into caviar, is the most valuable output of this fish. Given the high price of caviar, harvest of wild paddlefish in the United States is popular among commercial fishermen, which might lead to endangering wild stocks of this fish. Reservoir ranching is an extensive aquaculture method that could reduce harvest pressure on wild populations of paddlefish.

In Kentucky, where commercial harvests of wild paddlefish are allowed, paddlefish ranching in 130,000 ha of public reservoirs could be a practical alternative. However, this would also imply that the same body of water would be used for commercial fishing, sport fishing, and other recreational activities such as boating or water skiing. Hence, public opinion about reservoir ranching is important prior to instituting this type of aquaculture in public waters.

Corresponding to the above goal, the Aquaculture Research Center at Kentucky State University and Kentucky Department of Fish and Wildlife jointly conducted a random survey of Kentuckians to (1) educate them about reservoir ranching; and (2) elicit their opinion about whether reservoir ranching should be allowed in Kentucky's public waters. This survey was administered during 2003.

Prior to the survey, respondents received a brochure about paddlefish reservoir ranching which objectively outlined key facts about this method of aquaculture. In order to encourage people to read the brochure, it was succinct, visually attractive, and written using easy-to-understand script. The brochure explained that paddlefish are commercially valued for meat and roe, and the roe are harvestable from fish that are 8 years or older. It also discussed reservoir ranching management (i.e., stocking density, stocking and harvest times for paddlefish), types of commercial fishing activities to be expected in a reservoir (winter harvests of paddlefish using gill nets, once every 8-10 years), potential for income from sales of meat and roe, and main beneficiaries of this enterprise (i.e., farmers who stock and harvest, commercial fishermen, fish processors and retailers). Finally, the brochure mentioned several issues that were still unknown, such as the impact of reservoir ranching on existing fish stocks, environment, and sport fishing activities, and the expected income from reservoir ranching and its effect on local employment.

This paper summarizes the survey data indicating the perception of Kentucky's population towards reservoir ranching of paddlefish. We also investigate if any respondent characteristics exerted systematic influences on their opinion of reservoir ranching. While there is no other literature on public opinion about reservoir ranching, similar surveys have been conducted regarding resource management of public waters. For example, the University of Wisconsin Extension service conducted a public opinion survey about current conditions and management of lakes in southeast Wisconsin during 2001 (University of Wisconsin-Extension 2001). This survey revealed that the majority of lake residents were aware of lake management activities of the Wisconsin Department of Natural Resources; however, most respondents felt that lakeside residents must be educated about the harmful effects of dumping chemicals on the lake's natural populations.

The Minnesota Sea Grant also surveyed boaters in Ohio, Wisconsin, and Minnesota to investigate whether they were aware of the risks of spreading exotic species of animals in lakes (Gunderson 2004). The results indicated that Minnesota boaters were more conscientious than

Ohio or Wisconsin boaters with respect to controlling in introduction of exotic species prior to launching a boat.

MATERIALS AND METHODS

Data were collected through a random mail survey of 4,000 Kentucky residents from all 120 counties. However, only 478 observations out of the resulting 664 returned surveys were found to be useful for statistical analyses. Table 1 lists summary statistics of responses to questions taken from the survey instrument.

The data produced two dependent variables: (1) Hurt Sport Fish (respondents agreed or disagreed on whether reservoir ranching would damage sport fishing; they also had the opportunity to be neutral or express no opinion), and (2) RR-OK (respondents indicated whether or not they support instituting reservoir ranching in Kentucky's public reservoirs; they could also express "No opinion"). Statistical methods used in this paper involved applying contingency tables to determine whether respondent characteristics, such as age, gender, education, etc., affected their response to the two dependent variables, which defined their attitude towards reservoir ranching of paddlefish (Zar 1999). The resulting test statistics had a chi-squared distribution.

RESULTS

The response rate of the survey was 16.60 % (i.e., 664 replies). The survey data showed that over 383 out of 478 (80%) respondents favored instituting reservoir ranching in Kentucky (Table 1). Of the 95 individuals who did not support the establishment of reservoir ranching of paddlefish in Kentucky, 62 individuals (65%) believed that reservoir ranching would damage sport fishing.

Approximately 378 respondents (79%) felt that reservoir ranching would not hurt sport fishing in public waters. However, 100 respondents (21%) felt that reservoir ranching would damage sport fishing in public waters. Out of these 100 individuals, 38 favored instituting reservoir ranching of paddlefish in public waters. This suggested that several respondents felt that reservoir ranching might have adverse effects on sport fishing, but considered this enterprise to be sufficiently important to be tested in Kentucky.

TABLE 1. Summary statistics from the survey data (N = 478)

	Percentage
Respondents who	
Read the provided booklet of information on reservoir ranching (RR)	94.09
Strongly agree or agree that RR will disturb sport fishing	20.92
Strongly disagree or disagree that RR will disturb sport fishing	42.47
Are neutral in opinion or do not know if RR will disturb sport fishing	36.61
Support the establishment of RR in Kentucky	80.13
Do not support the establishment of RR in Kentucky	19.87
Respondent characteristics	
Males	78.66
Females	21.34
Age	
16-30 years old	6.49
31-40 years old	10.47
41-50 years old	28.03
51-60 years old	22.39
60 years or more	32.43
Education	
High school education or less	34.52
2-year college degree or technical education	25.11
4-year college degree	24.27
Graduate or professional degree	16.11
Occupation	
Farmer	8.58
Educator	28.66
Laborer	5.86
Business	10.25
Public servant	5.86
Professional	8.37
Other	32.43
Residence	
Rural (farm or non-farm)	37.87
Small town	20.92
Metropolitan (suburb or city)	41.21
Current Kentucky fishing license holders	44.77

Tables 2 and 3 reported any systematic effects of respondent characteristics on their opinion of reservoir ranching, as measured by our two dependent variables. Table 2 indicated that very few respondent characteristics (e.g., gender, age, etc.) had any effect on Hurt Sport Fish except for Fishing License and Education. In both cases, the chi-squared test statistics were statistically significant, implying that (1) proportionately more respondents with fishing licenses felt that reservoir ranching would harm sport fishing than respondents without fishing licenses (38% versus 27%), and (2) proportionately more respondents with at least a 4-year college education felt that reservoir ranching would harm sport fishing than respondents with less education (39% versus 28%). However, over 60% of respondents with fishing licenses and higher education, respectively, indicated that reservoir ranching would not damage sport fishing.

Table 3 illustrates a similar pattern of opinions with respect to instituting paddlefish reservoir ranching in Kentucky's public waters. As in Table 2, only two respondent characteristics (having a fishing license and education level) exerted a systematic effect on RR-OK. Individuals without fishing licenses were proportionately higher in supporting reservoir ranching than those with fishing licenses (83% versus 76%). Individuals with less-than-4 years of college were also proportionately higher in supporting reservoir ranching than those with higher education (84% versus 74%).

DISCUSSION

The purpose of this paper was to report the perceptions of Kentuckians towards paddlefish reservoir ranching in public waters. The data for the analysis came from a random survey of Kentucky residents, which was preceded by an educational brochure about paddlefish reservoir ranching, and its foreseeable impacts in public reservoirs. Very few other studies have been conducted in which citizens have been surveyed about an aquaculture enterprise that can occur in public waters. Most such studies were related to eliciting public opinions about the effectiveness of resource management activities conducted by state government agencies of natural resource preservation (University of Wisconsin-Extension 2001; Gunderson 2004).

The results of our analysis showed that over 80% of the respondents were in favor of instituting reservoir ranching in Kentucky's public waters. Approximately 79% of respondents felt that reservoir ranching would not harm sport fishing. Many respondents, including 28% of fish-

TABLE 2. Effect of independent variables on the dependent variable Hurt Sport Fish: Do you feel that ranching of paddlefish in public reservoirs will disturb sport fishing in the reservoirs?

Independent variable	Dependent variable = "Yes"	Dependent variable = "No"	Chi-squared test statistic ^a	Degrees of freedom
1. Fishing license holder			3.98*	1
Yes, I have a license	38.41% ^b	61.59%		
No license	27.63%	72.37%		
2. Gender			0.03	1
Male	32.79%	67.21%		
Female	33.93%	66.07%		
3. Age			3.78	4
16-30 years	33.33%	66.67%		
31-40 years	29.41%	70.59%		
41-50 years	27.91%	72.09%		
51-60 years	42.03%	57.97%		
60 years or more	32.22%	67.78%		
4. Profession			3.00	5
Farmer	28.57%	71.43%		
Professional	36.96%	63.04%		
Educator	50.00%	50.00%		
Business related	34.29%	65.71%		
Government	27.78%	72.22%		
Laborer	34.62%	65.39%		
5. Education			3.68*	1
2 years of college or less	28.57%	71.43%		
4 years of college or more	39.06%	60.94%		
6. Residence			0.72	2
Rural	35.25%	64.75%		
Small town	33.85%	66.15%		
Urban	30.17%	69.83%		

^aIf the test statistic is statistically significant for $P < 10\%$, we indicate this by an asterisk (*).

^bThis number should be interpreted as: of all respondents who have a current fishing license and who indicated either a "Yes" or "No" to the dependent variable, the percentage that answered "Yes" to the dependent variable.

TABLE 3. Effect of independent variables on the dependent variable RROK: Should paddlefish reservoir ranching be allowed in Kentucky's public waters?

Independent variable	Dependent variable = "Yes"	Dependent variable = "No"	Chi-squared test statistic ^a	Degrees of freedom
1. Fishing license holder			3.81*	1
Yes, I have a license	76.17% ^b	23.83% ^b		
No license	83.33%	16.67%		
2. Gender			0.58	1
Male	80.85%	19.15%		
Female	77.45%	22.55%		
3. Age			5.33	4
16-30 years	74.19%	25.81%		
31-40 years	82.35%	17.65%		
41-50 years	79.11%	20.89%		
51-60 years	74.44%	25.23%		
60 years or more	85.16%	14.39%		
4. Profession			7.92	5
Farmer	73.17%	26.83%		
Professional	78.83%	21.17%		
Educator	75.00%	25.00%		
Business related	77.55%	22.45%		
Government	92.86%	7.14%		
Laborer	65.00%	35.00%		
5. Education			7.40*	1
2 years of college or less	84.21%	15.79%		
4 years of college or more	74.09%	25.91%		
6. Residence			2.78	2
Rural	76.24%	23.76%		
Small town	82.00%	18.00%		
Urban	82.74%	17.26%		

^aIf the test statistic is statistically significant for $P < 10\%$, we indicate this by an asterisk (*).

^bThis number should be interpreted as: of all respondents who have a current fishing license and who indicated either a "Yes" or "No" to the dependent variable, the percentage that answered "Yes" to the dependent variable.

ing license holders, who believed that reservoir ranching might hurt sport fishing, were in favor of instituting reservoir ranching.

While the results showed a dominant support for paddlefish reservoir ranching, fishing license holders were significantly less supportive of this enterprise. Tables 2 and 3 made it clear that a main concern was the effect of reservoir ranching on sport fishing. Currently, there is no evidence that reservoir ranching of paddlefish would significantly affect sport fishing in the reservoir. Hence, this paper indicates that evaluating potential impacts of paddlefish on other fish populations should be a major impetus for future studies in reservoir ranching.

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